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Time-resolved Absorption Spectra of the Laser-dressed Hydrogen Atom MITSUKO MURAKAMI, Center for Quantum Science and Engineering, National Taiwan University, SHIH-I CHU, Department of Chemistry, University of Kansas — A theoretical study of the transient absorption spectra for the laser-dressed hydrogen atom based on the accurate numerical solution of the time-dependent Schrödinger equation is presented. The timing of absorption is controlled by the time delay between an isolated extreme ultraviolet (XUV) pulse and a dressing infrared (IR) field. We identify two different kinds of physical processes in the spectra. One is the formation of dressed states, signified by the appearance of sidebands between the XUV absorption lines separated by one IR-photon energy. We show that their population is maximized when the XUV pulse coincides with the zero-crossing of the IR field, and that their energy can be manipulated by using a chirped IR field. The other process is the dynamical AC Stark shift induced by the IR field and probed by the XUV pulse. Our calculations indicate that the accidental degeneracy of the hydrogen atom leads to the multiple splittings of each XUV absorption line whose separations change in response to a slowly-varying IR envelope. Furthermore, we observe the Autler-Townes doublets for the n=2 and 3 states using the 656 nm dressing field, but their separation does not agree with the prediction by the conventional 3-level model that neglects the dynamical AC Stark effects.

Shih-I Chu
Department of Chemistry, University of Kansas

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